

WHAT IS CLAIMED IS:

- 1 1. A method for decomposing bromate ions contained in a  
2 liquid, said method comprising:  
3 bringing said liquid into contact with a photocatalyst;  
4 and  
5 irradiating said photocatalyst with a light ray having  
6 an energy that is not lower than that of a band gap of said  
7 photocatalyst, thereby generating a photocatalytic reaction to  
8 decompose said bromate ions.
- 1 2. A method according to claim 1, wherein, prior to said  
2 irradiating, pH of said liquid is made to be not higher than  
3 isoelectric point of said photocatalyst by introducing an acid  
4 solution into said liquid.
- 1 3. An apparatus for decomposing bromate ions contained  
2 in a liquid, said apparatus comprising:  
3 a first section for generating therein a photocatalytic  
4 reaction to decompose said bromate ions;  
5 a photocatalyst adapted to be brought into contact with  
6 said liquid in said first section; and  
7 a light source for irradiating said photocatalyst with a  
8 light ray having an energy that is not lower than that of a band  
9 gap of said photocatalyst such that said photocatalytic reaction  
10 is generated in said first section when said photocatalyst is in  
11 contact with said liquid.
- 1 4. An apparatus according to claim 3, wherein said  
2 apparatus further comprises a first device for adding an acid  
3 solution to said liquid before said liquid is brought into contact  
4 with said photocatalyst.

1 5. An apparatus according to claim 4, wherein said  
2 apparatus further comprises a pH meter for measuring pH of  
3 said liquid, and wherein said first device comprises a means for  
4 changing an amount of said acid solution added to said liquid,  
5 in accordance with said pH measured by said pH meter,  
6 thereby adjusting said pH of said liquid.

1 6. An apparatus according to claim 5, wherein said means  
2 is configured such that said pH of said liquid is adjusted to not  
3 higher than 4.

1 7. An apparatus according to claim 3, wherein said  
2 apparatus further comprises a second device for removing a  
3 dissolved oxygen from said liquid by aerating said liquid with a  
4 gas that is free from oxygen.

1 8. An apparatus according to claim 7, wherein said  
2 apparatus further comprises a second section positioned  
3 upstream of said first section such that said dissolved oxygen is  
4 removed from said liquid by said second device in said second  
5 section and then said photocatalytic reaction is generated in  
6 said first section.

1 9. An apparatus according to claim 7, wherein said  
2 apparatus is configured such that said dissolved oxygen is  
3 removed from said liquid in said first section.

1 10. An apparatus according to claim 3, wherein said  
2 apparatus further comprises a third device for adding an agent  
3 to said liquid before said liquid is brought into contact with  
4 said photocatalyst, said agent eliminating holes that are  
5 produced together with electrons by said photocatalytic  
6 reaction.

10083470-02270E

1 11. An apparatus for purifying a liquid containing bromide  
2 ions and/or bromate ions, said apparatus comprising:

3 a first section for treating said liquid with ozone to  
4 remove an organic matter of said liquid and to sterilize said  
5 liquid;

6 a second section for removing said ozone from said  
7 liquid, said second section being downstream of said first  
8 section such that said liquid is allowed to flow from said first  
9 section to said second section;

10 a third section for generating therein a photocatalytic  
11 reaction, said third section being positioned downstream of said  
12 second section such that said liquid is allowed to flow from said  
13 second section to said third section;

14 a photocatalyst adapted to be brought into contact with  
15 said liquid in said third section; and

16 a light source for irradiating said photocatalyst with a  
17 light ray having an energy that is not lower than that of a band  
18 gap of said photocatalyst such that said photocatalytic reaction  
19 is generated in said third section when said photocatalyst is in  
20 contact with said liquid.

1 12. An apparatus according to claim 11, wherein said  
2 second section comprises a means for aerating said liquid to  
3 remove said ozone from said liquid.

1 13. An apparatus according to claim 11, wherein said  
2 apparatus further comprises (1) a first means for adjusting pH  
3 of said liquid before said liquid enters said third section and (2)  
4 a second means for adjusting pH of said liquid after said liquid  
5 has left said third section.

1 14. An apparatus for purifying a liquid containing bromide  
2 ions and/or bromate ions, said apparatus comprising:

3 a first section for subjecting said liquid to an  
4 accelerated oxidation by an oxidizer to remove an organic  
5 matter of said liquid and to sterilize said liquid;

6 a second section for generating therein a photocatalytic  
7 reaction, said second section being positioned downstream of  
8 said first section such that said liquid is allowed to flow from  
9 said first section to said second section;

10 a photocatalyst adapted to be brought into contact with  
11 said liquid in said second section; and

12 a light source for irradiating said photocatalyst with a  
13 light ray having an energy that is not lower than that of a band  
14 gap of said photocatalyst such that said photocatalytic reaction  
15 is generated in said second section when said photocatalyst is  
16 in contact with said liquid.

1 15. An apparatus according to claim 14, wherein said  
2 apparatus further comprises (1) a first means for adjusting pH  
3 of said liquid before said liquid enters said second section and  
4 (2) a second means for adjusting pH of said liquid after said  
5 liquid has left said second section.

1 16. An apparatus according to claim 14, wherein said first  
2 section comprises a combination of a means for generating an  
3 ozone gas and a means for generating an ultraviolet ray for  
4 said accelerated oxidation such that hydroxyl radicals as said  
5 oxidizer are formed by irradiating said ozone gas with said  
6 ultraviolet ray.

1 17. An apparatus for purifying a liquid containing bromide  
2 ions and/or bromate ions, said apparatus comprising:

3 a first section for treating said liquid with ozone to  
4 remove a first organic matter of said liquid and to sterilize said  
5 liquid;

6 a second section for subjecting said liquid to an  
7 accelerated oxidation by an oxidizer to remove a second organic  
8 matter of said liquid and to further sterilize said liquid, said  
9 second section being positioned downstream of said first section  
10 such that said liquid is allowed to flow from said first section to  
11 said second section;

12 a third section for generating therein a photocatalytic  
13 reaction, said third section being positioned downstream of said  
14 second section such that said liquid is allowed to flow from said  
15 second section to said third section;

16 a photocatalyst adapted to be brought into contact with  
17 said liquid in said third section; and

18 a light source for irradiating said photocatalyst with a  
19 light ray having an energy that is not lower than that of a band  
20 gap of said photocatalyst such that said photocatalytic reaction  
21 is generated in said third section when said photocatalyst is in  
22 contact with said liquid.

1 18. An apparatus according to claim 17, wherein said  
2 apparatus further comprises (1) a first means for adjusting pH  
3 of said liquid before said liquid enters said third section and (2)  
4 a second means for adjusting pH of said liquid after said liquid  
5 has left said third section.

1 19. An apparatus for purifying a liquid containing bromide  
2 ions and/or bromate ions, said apparatus comprising:

3 a first section for removing carbonic acid from said  
4 liquid, said first section comprising (1) a first means for  
5 adjusting pH of said liquid to allow said removing and (2) a

6 second means for introducing a gas into said liquid to allow  
7 said removing;

8 a second section for subjecting said liquid to an  
9 accelerated oxidation by an oxidizer to remove an organic  
10 matter of said liquid and to sterilize said liquid, said second  
11 section being positioned downstream of said first section such  
12 that said liquid is allowed to flow from said first section to said  
13 second section;

14 a third section for generating therein a photocatalytic  
15 reaction, said third section being positioned downstream of said  
16 second section such that said liquid is allowed to flow from said  
17 second section to said third section;

18 a photocatalyst adapted to be brought into contact with  
19 said liquid in said third section; and

20 a light source for irradiating said photocatalyst with a  
21 light ray having an energy that is not lower than that of a band  
22 gap of said photocatalyst such that said photocatalytic reaction  
23 is generated in said third section when said photocatalyst is in  
24 contact with said liquid.

1 20. A method for decomposing bromate ions contained in a  
2 liquid, said method comprising:

3 bringing said liquid into contact with a photocatalyst,  
4 said photocatalyst comprising at least one metal oxide  
5 including titanium and a metal having an electronegativity  
6 lower than that of titanium such that said photocatalyst has an  
7 isoelectric point of at least about 7;

8 irradiating said photocatalyst with a light ray having  
9 an energy that is not lower than that of a band gap of said  
10 photocatalyst, thereby generating a photocatalytic reaction to  
11 decompose said bromate ions.

1 21. A method according to claim 20, wherein said at least  
2 one metal oxide is a double oxide containing in the molecule  
3 titanium and said metal.

1 22. A method according to claim 21, wherein said double  
2 oxide is at least one of  $\text{SrTiO}_3$  and  $\text{BaTiO}_3$ .

1 23. A method according to claim 20, wherein said at least  
2 one metal oxide is a combination of titanium oxide and an oxide  
3 of said metal.

1 24. A method according to claim 23, wherein said oxide of  
2 said metal carries thereon said titanium oxide.

1 25. A method according to claim 20, wherein said  
2 irradiating is conducted under a condition that said liquid has  
3 a pH of at least about 7.

1 26. An apparatus for decomposing bromate ions contained  
2 in a liquid, said apparatus comprising:  
3 a section for generating therein a photocatalytic  
4 reaction to decompose said bromate ions;  
5 a photocatalyst adapted to be brought into contact with  
6 said liquid in said section, said photocatalyst comprising at  
7 least one metal oxide including titanium and a metal having an  
8 electronegativity lower than that of titanium such that said  
9 photocatalyst has an isoelectric point of at least about 7; and  
10 a light source for irradiating said photocatalyst with a  
11 light ray having an energy that is not lower than that of a band  
12 gap of said photocatalyst such that said photocatalytic reaction  
13 is generated in said section when said photocatalyst is in  
14 contact with said liquid.  
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